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REMARKS ON THE SAN MARCOS SALAMANDER, TYPHLOMOLGE RATHBUNI STEJNEGER.

W. W. NORMAN.¹

THROUGH the kindness of Mr. Leary, Superintendent of the U. S. Fish Hatchery at San Marcos, Texas, the Biological Laboratory of the University of Texas became the possessor of a small number of living salamanders that came up from subterranean waters 181 feet below the surface.

It has been the aim of the writer to study the habits of these strange animals, but through ill-luck only a single specimen is at the present writing alive, and the new arrivals at the well are becoming scarce.

For a systematic description of the animals the reader is referred to Stejneger's paper in the *Proc. of the U. S. Nat. Mus.*, Vol. XVIII, No. 1088.

A good idea of the animal may be had from the pictures accompanying this description.

The animals were kept in a large shallow basin of water containing water plants and some small organisms, such as water fleas.

Unless disturbed, the salamanders appear at all times either resting, or very slowly walking along. They move a few steps at a time, wait awhile, and go again. They have no particular pose when quiet except that they always rest on their four feet, holding themselves up from the bottom of the vessel, and frequently retain the position of the legs as if in the act of walking. Indeed, this position represents them as if suddenly

¹ A few years ago the late Professor Norman secured a number of specimens of the Texas cave salamander for me, to enable me to study the structure of their eyes. He himself intended to study the habits of the species. In September of 1899, Mrs. Norman placed his notes and photographs in my hands, and these are reproduced in this paper. The notes are just as he wrote them. I have added as foot notes a few observations on living specimens kindly furnished me by Superintendent J. L. Leary, of San Marcos. — C. H. EIGENMANN.

stopped. This is beautifully shown in the photograph (Fig. 1) where the large animal has the left legs near each other, and the right far apart. If the vessel contains, for example, water-cress, they crawl in among the branches, stop as when walking on firm bottom, with the legs in such a position as fits easiest for gliding in among the twigs.

They are never seen to move faster than a slow, easy walk, except when disturbed by external stimuli.¹ Then one of three methods of locomotion may follow.

1. The walking speed may pass into a grotesque run by long strides and corresponding winds of the body; or, 2. This passes into a combined movement of legs and tail, the last act-

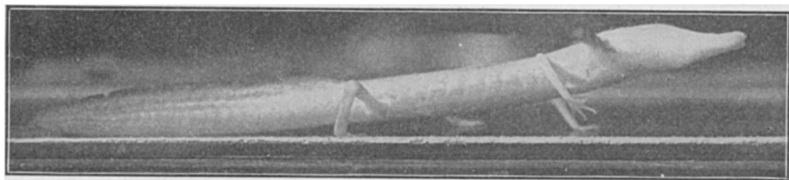


FIG. 1. — Photograph of a living salamander from the side.

ing as fin. 3. At its greatest speed the legs are laid lengthwise against the body, and the tail only used for locomotion.

The legs are exceedingly slender and weak. If the animal is placed on a table out of water, the body falls to the floor, and at best the animal may wriggle a few inches.

¹ The motion in water is, for the most part, slow and cautious, the movement of the long legs being apparently calculated to produce the least commotion in the water. The motion suggests that of a cat creeping upon its prey, or the elephantine progression of the snapping turtle. The feet are lifted high in walking, and the body is kept from the bottom by the full length of the fore arm and leg. In ordinary progression the body slopes from the nose to the tail, which drags (Fig. 1). The method of moving the limbs is as follows: Left hand and, when this is nearly ready to place, or usually when placed, the right foot. When the right foot is placed, then the right hand and then the left foot. As the hand of one side is not raised till the foot of the same side is placed, the enormous strides of the long-legged creature causes it to step on its hand or even beyond. Its natural gait is a deliberate progression by means of its feet with three feet usually on the ground. Any attempt at great rapidity by this means of locomotion results in a most undignified and futile wriggle. When going slowly the head is held sloping upward. When walking rapidly it is held sloping down, so that the snout is near the ground.

In water, however, the weight of the salamander is so little that the legs are amply strong for its locomotion. Professor Stejneger lost sight of this point when he guessed that the animal used its tail for locomotion and its legs as feelers, for he says: "Viewed in connection with the well-developed, finned swimming-tail, it can be safely assumed that these extraordinarily slender and elongated legs are not used for locomotion, and the conviction is irresistible that in the inky darkness of the subterranean waters they serve the animal as feelers."

No definite information has been obtained as to their habits in nature.

They show no reaction against light, either as a response by motion to the direction of the rays or to the quantity of light.

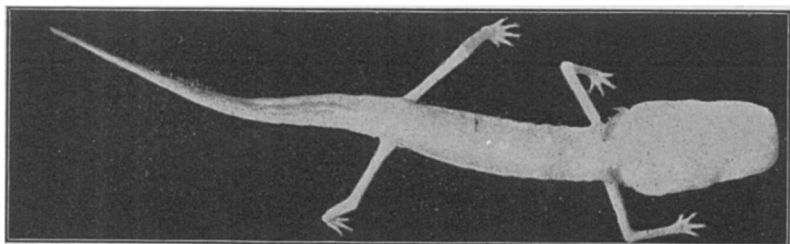


FIG. 2. — The same as Fig. 1, but from above.

If kept in a vessel, one-half of which is dark and the other half light, the animal is found about as much in one as the other, and on emerging into light from the dark half indicates in no way an awareness of the difference.

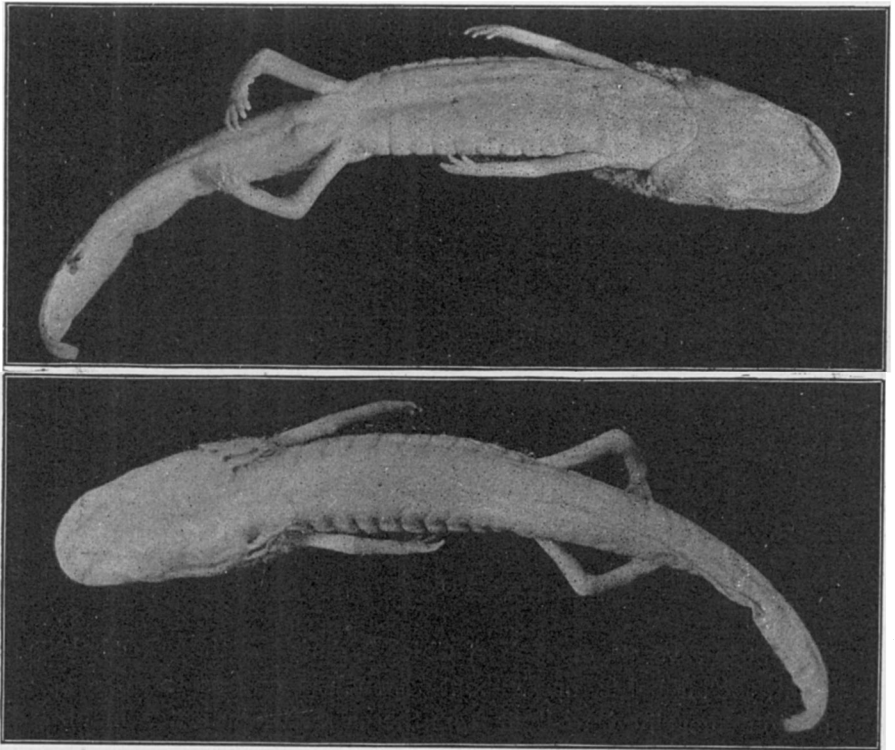
If in a tangle of plants, as watercress, they are found there about the same as in any other part of the vessel.

If they are headed against a current, the flowing water acts as stimulus urging them on. If the current strikes them from behind, they move more rapidly in the direction of flow.

The sense of touch is highly developed. There is, however, no experimental evidence that this is confined to any particular region. If the surface of the body is touched anywhere except at the blunt truncated snout, the animal responds at once by moving away. If the stimulus causes it to swim away, it may

go (say 12 or 16 inches) till it strikes the side of the vessel, after which it soon comes to a standstill.

If, however, it is struck say with the flat side of a scalpel handle sufficiently hard to move the entire animal even an inch backwards, it may not react, and this may often be repeated



FIGS. 3 and 4.

FIG. 3. — Dorsal surface of a salamander preserved in formalin.

FIG. 4. — Ventral surface of the same specimen.

before it reacts by moving away. A possible explanation of this is that in normal life it is every day striking itself against obstacles, especially the sides of the vessel (when in confinement).

The animal was kept in water about an inch deep, so that its head was near the surface. The waves of the water set going by a gentle puff of the breath act as a sure stimulus. It is exceedingly sensitive to any motion of the water.

But little evidence thus far shows in favor of a sense of smell. All attempts at feeding (except one) have been in vain. No attention was given to meat or other articles placed near it. Examination of a dead specimen showed chitinous remains of such Crustacea as Cyclops. To-day (April 18) I offered a salamander a small piece of the abdominal muscle of a crayfish. The bait was held by means of forceps about 5 mm. in front of the snout. The animal moved slightly forward, and the bait was kept at about the same distance. Suddenly it was snapped off and swallowed. The animal snapped off a second piece, but a third was refused.¹

¹ If a glass rod or other object is held a little to one side and in front of the animal, it will cautiously turn its head in the direction of the rod. If the latter is then made to describe an arc about the side of the salamander, the head will follow it with a continuous motion, expressive of the greatest caution, as far as it can be followed without moving any of the limbs. A sudden jar, produced by tapping the rod on the bottom of the aquarium at such a time, causes the salamander to jerk its head back and rear back on its limbs as far as it can. The same effect is produced if the rod is introduced too rapidly.

If a piece of crayfish tail is held by pincers in the fingers a short distance in front or to the side of the head of the salamander, there is the same cautious motion forward till the snout comes in contact with it. There is then a momentary hesitation, followed by a sudden snap and seizure.

The salamander may be pulled from side to side by the meat, after it has once secured a hold, without causing it to let go. All of its caution is apparently directed in approaching the food without disturbance. After it has secured a hold it will struggle to maintain it.